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Healthcare and Out-of-Pocket Costs Associated With *Clostridioides difficile* Infection Among US Adults 18–64 Years of Age

Holly Yu,[1]* Tamuno Alfred,[2] Jingying Zhou,[3] Jennifer Judy,[2] Margaret A. Olsen[4]

[1]Pfizer Inc, Collegeville, PA, USA; [2]Pfizer Inc, New York, NY, USA; [3]Pfizer Inc, Peapack, NJ, USA; [4]Washington University School of Medicine, St. Louis, MO, USA

*Presenting author

For more information please contact:
Holly Yu
Health Economics and Outcomes Research
Pfizer Inc
500 Arcola Rd
Collegeville, PA, 19426
Tel: (484) 865-3459
Email: Holly.Yu@pfizer.com

INTRODUCTION

- *Clostridioides difficile* infection (CDI) is a life-threatening illness with a high societal burden:
  - Nearly 500,000 people/year in the United States will develop CDI.[1]
  - Estimated attributable mortality at 12 months after CDI exposure is 7.9% among individuals aged ≥65 years.[1]
  - Cost modeling estimates for the US alone were $5.4 billion, primarily driven by hospitalization.[2]
- The expense of CDI is primarily associated with significantly longer hospital stays and heavier utilization of inpatient healthcare resources.[1,3]
- Recent estimates have indicated mean per-person treatment costs for primary CDI are approximately $13,500/person higher than for matched patients without CDI.[1]
- CDI costs have been studied for the elderly (≥65 years old), but costs associated with CDI specifically for adults <65 years old remain unclear.[1,2,4]

OBJECTIVE

- The goal of this study was to quantify healthcare costs and patient out-of-pocket (OOP) medical costs among adults aged 18–64 years and thus inform future analyses on reducing CDI-related healthcare utilization and costs to both patients and the healthcare system.

METHODS

- This was a retrospective cohort study using de-identified claims data from the Optum® Clinformatics® Data Mart (Eden Prairie, MN) to identify first CDI episodes from 2016–2018 among individuals 18–64 years of age in the USA and insured under commercial plans.
- CDI was identified via:
  - CDI diagnosis defined by International Classification of Diseases (ICD) 9th Revision diagnosis code 008.45 or ICD 10th Revision diagnosis codes A04.7*.
  - An inpatient CDI diagnosis; a combination of CDI outpatient diagnosis or toxin test (ABTT) with antibiotic defined as receipt of non-topical metronidazole, oral vancomycin, or fidaxomicin therapy within 14 days of an outpatient CDI diagnosis or test.
- Healthcare costs were evaluated for identified CDI (CDI+) cases and 1:1 propensity score-matched (CDI–) controls.
- Both CDI+ cases and controls had prior continuous database enrollment for at least 12 months and were followed up for 12 months post-index date unless preceded by death.
- Healthcare costs included all allowable amounts for inpatient, outpatient, and emergency department visits, pharmacy prescriptions, etc., as determined by insurance plans. Patient OOP costs included deductibles, copays, and co-insurance charges designated as patient responsibility by the insurance plan.
- All costs were analyzed according to:
  - Age group: 18–49 or 50–64 years of age
  - Acquisition type: healthcare-associated (HA) or community-associated (CA)
  - Hospitalization status within 2 months of the index date

*Refers to 2 separate codes.

RESULTS

- Of 13,820 CDI+ cases and 4,027,386 potential controls in the database, 12,999 cases were matched to a control (50–64-years-old, n=6332; 18–49-years-old, n=6667).
- Demographic and clinical characteristics of cases and controls before and after propensity score matching are presented in **Tables 1 and 2**.

Table 1. Demographic and Characteristics Before and After Propensity Score Matching (50–64-Year Age Group)

	Pre-matching		Post-matching	
Variable*	CDI+ n=6787	CDI– n=1,363,715	CDI+ n=6332	CDI– n=6332
Age in index year, y				
Mean (SD)	57.2 ± 4.2	56.6 ± 4.1	57.2 ± 4.2	57.2 ± 4.1
Sex, n (%)				
Female	4005 (59.0)	676,519 (49.6)	3749 (59.2)	3774 (59.6)
Acquisition status – first CDI case, n (%)				
Healthcare acquired	1055 (15.5)	N/A	750 (11.8)	N/A
Indeterminate	339 (5.0)	N/A	283 (4.5)	N/A
Community acquired	5393 (79.5)	N/A	5299 (83.7)	N/A
Hospitalization status, n (%)				
Hospitalized	1382 (20.4)		1081 (17.1)	
Charlson Comorbidity Index				
Mean (SD)	1.95 ± 2.61	0.53 ± 1.13	1.74 ± 2.42	1.61 ± 2.22
Comorbidities, n (%)†				
Myocardial infarction	304 (4.5)	14,108 (1.0)	246 (3.9)	228 (3.6)
Congestive heart failure	543 (8.0)	20,362 (1.5)	425 (6.7)	365 (5.8)
Diabetes without chronic complications	894 (13.2)	128,741 (9.4)	827 (13.1)	927 (14.6)
Diabetes with chronic complications	546 (8.0)	39,538 (2.9)	455 (7.2)	394 (6.2)
Chronic pulmonary disease	1497 (22.1)	114,288 (8.4)	1343 (21.2)	1355 (21.4)
Renal disease	667 (9.8)	26,935 (2.0)	530 (8.4)	483 (7.6)
Crohn's disease	197 (2.9)	4232 (<1)	155 (2.4)	181 (2.9)
Ulcerative colitis	317 (4.7)	6241 (<1)	245 (3.9)	302 (4.8)
Septicemia	856 (12.6)	5609 (<1)	570 (9.0)	392 (6.2)
Irritable bowel syndrome	419 (6.2)	16,901 (1.2)	363 (5.7)	451 (7.1)

CDI, *C difficile* infection; SD, standard deviation.
*A subset of >60 variables included in propensity score matching.
†During 12 months pre-index.

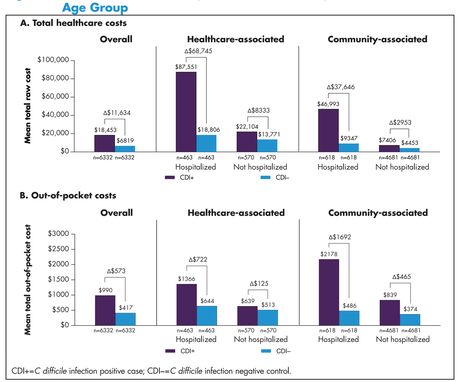
Table 2. Demographic and Characteristics Before and After Propensity Score Matching (18–49-Year Age Group)

	Pre-matching		Post-matching	
Variable*	CDI+ n=7033	CDI– n=2,663,671	CDI+ n=6667	CDI– n=6667
Age in index year, y				
Mean (SD)	36.1 ± 9.2	34.6 ± 9.2	36.2 ± 9.1	36.1 ± 9.2
Sex, n (%)				
Female	4146 (59.0)	1,282,984 (48.2)	3946 (59.2)	4167 (62.5)
Acquisition status – first CDI case, n (%)				
Healthcare acquired	693 (9.9)	N/A	495 (7.4)	N/A
Indeterminate	242 (3.4)	N/A	195 (2.9)	N/A
Community acquired	6098 (86.7)	N/A	5977 (89.7)	N/A
Hospitalization status, n (%)				
Hospitalized	904 (12.9)		707 (10.6)	
Charlson Comorbidity Index				
Mean (SD)	0.88 ± 1.74	0.16 ± 0.59	0.76 ± 1.56	0.69 ± 1.46
Comorbidities, n (%)†				
Myocardial infarction	83 (1.2)	3599 (<1)	65 (<1)	42 (<1)
Congestive heart failure	170 (2.4)	7211 (<1)	124 (1.9)	95 (1.4)
Diabetes without chronic complications	433 (6.2)	69,360 (2.6)	405 (6.1)	365 (5.5)
Diabetes with chronic complications	158 (2.2)	13,543 (<1)	131 (2.0)	124 (1.9)
Chronic pulmonary disease	1081 (15.4)	142,120 (5.3)	998 (15.0)	1008 (15.1)
Renal disease	275 (3.9)	10,076 (<1)	221 (3.3)	156 (2.3)
Crohn's disease	382 (5.4)	6860 (<1)	304 (4.6)	246 (3.7)
Ulcerative colitis	568 (8.1)	7279 (<1)	452 (6.8)	281 (4.2)
Septicemia	553 (79)	4820 (<1)	360 (5.4)	255 (3.8)
Irritable bowel syndrome	517 (7.4)	23,942 (<1)	442 (6.6)	421 (6.3)

CDI, *C difficile* infection; SD, standard deviation.
*A subset of >60 variables included in propensity score matching.
†During 12 months pre-index.

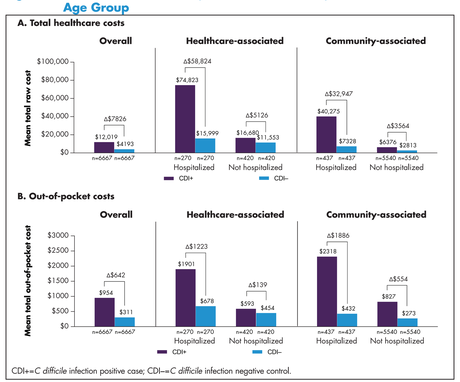
- For the 50–64-year age group **(Figure 1)**:
  - CDI imposed an additional $11,634 in mean total healthcare costs at 2 months post-index.
  - Mean attributable costs were higher for hospitalized cases for both the HA and CA acquisition groups than for their non-hospitalized counterparts.
  - CDI increased overall mean OOP expenses by $573; OOP costs in the CA group increased more than the HA group whether hospitalized or non-hospitalized.
- For the 18–49-year age group **(Figure 2)**:
  - CDI imposed an additional $7826 in mean total healthcare costs at 2 months post-index.
  - Mean attributable costs were higher for hospitalized cases for both the HA and CA acquisition groups than for their non-hospitalized counterparts.
  - CDI increased overall mean OOP costs by $642; OOP costs in the CA group increased more than the HA group whether hospitalized or non-hospitalized.

Figure 1. CDI-attributable Costs (2 Months Post-index) in the 50–64-Year Age Group



CDI+=*C difficile* infection positive case; CDI–=*C difficile* infection negative control.

Figure 2. CDI-attributable Costs (2 Months Post-index) in the 18–49-Year Age Group



CDI+=*C difficile* infection positive case; CDI–=*C difficile* infection negative control.

CONCLUSIONS

- **CDI imposed a significant additional cost burden on US adults aged 18–64 years regardless of acquisition type.**
- **Hospitalization drove a large proportion of the CDI-attributable cost increases regardless of acquisition type.**
- **The additional CDI cost burden overall was lower for the 18–49-year-old group than the 50–64-year-old group, but their out-of-pocket expenses were slightly higher.**
- **Prevention of CDI in younger adults may significantly reduce costs to both the healthcare system and patients, especially younger adults with increased risk for CDI.**

REFERENCES

1. Yu H, et al. *Clin Infect Dis.* 2022. ciac467, https://doi.org/10.1093/cid/ciac467
2. Bouza E. *Clin Microbiol Infect.* 2012;18 Suppl 6:5-12.
3. Desai K, et al. *BMC Infect Dis.* 2016;16:303.
4. Sammons JS, et al. *Clin Infect Dis.* 2013;57(1):1-8.

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DISCLOSURES

Holly Yu, Tamuno Alfred, Jingying Zhou, and Jennifer Judy are employees of Pfizer Inc and may hold stock or stock options. Margaret A. Olsen reports grant funding and consulting work funded by Pfizer.

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